BRC
BIODYNAMIC RESEARCH CORPORATION

14 February 2011

Mr. Lance D. Richards
Civerolo, Gralow, Hill & Curtis
20 First Plaza Ctr NW, Suite 500
Albuquerque, NM 87103-0887

Re: *Chavez, Herman vs. Marten Transport*
Your Ref #: *12902.002*

Dear Mr. Richards:

I am pleased to submit this report rendering my opinions regarding the above referenced matter. Included in this document is a summary of findings pertinent to the formulation of my opinions concerning Herman Chavez' alleged injuries, reported to have resulted from a motor vehicle incident.

I am an engineering trained and medically qualified consultant employed by Biodynamic Research Corporation (BRC), and have been so since August 2003. I consult in the scientific disciplines of vehicle dynamics (accident reconstruction), occupant kinematics, biomechanics, and medicine, a combined process termed Injury Causation Analysis (ICA) (also known as Injury Reconstruction). My Testifying History for the past four years is listed in Enclosure A to this report.

My educational background includes a Bachelor of Engineering and Doctorate of Medicine degrees. I hold an accreditation in accident reconstruction (ACTAR #1699). My professional background is documented in detail in the copy of my curriculum vitae in Enclosure B.

The education, training, knowledge, skills and experience reflected in my curriculum vitae provide the qualifications essential to each phase of an ICA, and these attributes as directly related to the subject case are amplified in Enclosure C.

The process of ICA is the examination of a collision or other potentially harmful event in order to understand its nature and to determine its essential features, including the causation of injuries. The primary goal of ICA is prediction and prevention of injuries, but it can be and is used to explain the relationship between the physical characteristics of an event (in terms of applied

acceleration, and therefore of force, and therefore of the likelihood of injury) and the probability of, and severity of, injury as claimed by the plaintiff and his/her treating physicians.

The scientific validity and the process of ICA are presented in detail in Enclosure D.

I have utilized my expertise in science, medicine and biomechanics to perform an injury causation analysis in order to reach my conclusions.

During the course of my study of this matter, I have had access to the following items:

- State of New Mexico Uniform Crash Report (12/8/2006);
- State of New Mexico Uniform Crash Report (2/16/2005);
- Images of Accident Scene;
- Various Pleadings;
- Depositions of:

  Mario Sepulveda
  Isabel Chavez
  Joe Herman Chavez, Sr.
  Dr. T. Grace
  Steve Stamper
  Sandra Hoyt
  Joe Ayala;

- Medical Records of Herman Chavez from:

  Presbyterian Hospital
  X-ray Association of New Mexico
  El Camino Imaging Center
  Albuquerque Imaging
  Concentra Medical Centers
  Dr. M. Erasmus
  Southwest Interventional Pain Specialists, P.C.
  Spine, Orthopaedic & Rehabilitation Center
  Pain Diagnosis Consultants
  Paradigm Physical Therapy and Wellness
  Therapeutic Innovations Physical Therapy, Inc.
  New Mexico Spine
  New Mexico Orthopaedics
  Doctor on Call
  Care More Chiropractic Centers
  Dr. J. Mertz

Langford Sports and Physical Therapy, Inc.
Rio Abajo Family Practice, PC
Presbyterian Medical Group
Socorro General Hospital
Dr. D. Garcia;

- Workers Compensation Complaint; and
- Reports of:

James Acock
J.T. Hayes.

I have arrived at the following observations and preliminary opinions:

- On 8 December 2006, Mr. Chavez was operating a Target Pro 65 III concrete saw on US 54 (sic) at its intersection with Lois Lane in Santa Rosa, New Mexico. Mr. Chavez was operating the saw on the west side of the roadway. Traveling southbound on US 84 was a 2007 Peterbilt 357 tractor pulling a 53' dry van trailer. The Peterbilt came to a stop after being signaled to do so by construction personnel. The tractor trailer subsequently moved forward allegedly causing the concrete saw to tip onto its left side.
- In Mr. Chavez' First Amended Complaint he said he was jerked sharply to the right. In Mr. Chavez' answers to interrogatories he said he was jerked sharply to the left. There were no witnesses, other than Mr. Chavez, to the actual contact between the Peterbilt and the concrete saw. The flag man, Mr. Mario Sepulveda, stated he heard a cracking sound and after the tractor had passed he saw the concrete saw on the ground and Mr. Chavez standing next to it. The foreman at the site, Mr. Joe Ayala, stated he saw the concrete saw falling onto its side and Mr. Chavez trying to hold it. He said Mr. Chavez was to the south side of the saw. Mr. Ayala believed that a handle on the concrete saw had interacted with the Peterbilt. He stated that Mr. Chavez never fell down and Mr. Chavez also confirmed that he did not fall down.
- Mr. Chavez' medical history included neck and back complaints after motor vehicle incidents in 1998 and 2005. During this period, various imaging studies showed degenerative changes in Mr. Chavez' cervical and lumbar spine.
- Mr. Chavez has stated that he visited an urgent care clinic the day after the subject event but there is no record of this visit having taken place. On 11 December 2006, three days after the subject event, Mr. Chavez was seen by Dr. G. Colocho at Concentra Medical Centers. Mr. Chavez stated he had been jerked sideways when the saw was hit by the Peterbilt. Dr. Colocho recorded that Mr. Chavez had non-radiating neck and left shoulder pain rated at 3/10. He stated that Mr. Chavez' neck range of motion was full "with pain" and there was mild focal left-sided neck tenderness. Mr. Chavez' left shoulder was completely normal with a full range of motion. Dr. Colocho obtained x-rays of Mr. Chavez' cervical spine and interpreted these as showing significant degenerative disc disease and some facet arthrosis. He diagnosed Mr. Chavez with cervical and trapezius

muscle strains. The following day, Mr. Chavez underwent a physical therapy evaluation at Concentra Medical Centers. It was noted that in Mr. Chavez' past medical history he had minor low back pain secondary to an MVA 8 years ago. Mr. Chavez underwent 5 physical therapy treatment sessions ending on 2 January 2007.

- On 18 December 2006, Mr. Chavez was seen by Dr. Colocho for follow-up. Mr. Chavez complained of left-sided neck pain rated 3/10 and now complained of paresthesias in both radial nerve distributions. Dr. Colocho's neurological examination of Mr. Chavez was normal. Mr. Chavez had full range of motion of his neck "with pain" and focal mild left-sided tenderness. His left shoulder had a full range of motion without pain. On 27 December 2006, Dr. Colocho stated that Mr. Chavez was continuing to have mild left-sided neck pain rated 3/10 and that there was still radiation into his bilateral radial nerve distributions.
- On 15 January 2007, an MRI study of Mr. Chavez' cervical spine showed degenerative bone marrow edema in his C4 and C5 vertebral bodies. At C3-4, C4-5 and C6-7, there were disc osteophyte complexes that effaced the thecal sac.
- On 17 January 2007, Mr. Chavez saw Dr. Colocho for follow up but this time Mr. Chavez was complaining of pain in both sides of his neck with the pain radiating into both of his hands. Dr. Colocho's physical examination of Mr. Chavez was unchanged from that previously documented.
- On 22 January 2007, Mr. Chavez saw Dr. M. Erasmus, a neurosurgeon, for neck and back pain with numbness of his hands and burning pain into his legs. Mr. Chavez reported that his pain was now 8/10.
- On 31 January 2007, Mr. Chavez saw Dr. J. Rice, a pain management specialist, for neck and low back pain. Mr. Chavez reported that his neck pain was radiating into both shoulders and posterior forearms. He complained of numbness and tingling into his ulnar and radial aspects of both hands. His low back pain radiated into the anterolateral aspect of both his thighs and occasionally his posterior thighs. He also complained of tingling extending to his toes. That same day, Dr. Rice performed a cervical interlaminar epidural steroid injection (ESI) and repeated this at a different level on 15 February 2007. On 7 June 2007, Dr. Rice performed a lumbar ESI. On 21 June 2007, Dr. Rice performed bilateral L3-4 through L5-S1 facet joint injections.
- Between 26 February 2007 and 20 July 2007, Mr. Chavez saw Dr. Erasmus for follow-up. On 20 July 2007, Dr. Erasmus performed on Mr. Chavez an anterior cervical discectomy and fusion at C3-4 utilizing an interdisc spacer. Postoperatively, Mr. Chavez continued to have the same complaints that he had preoperatively.
- On 5 February 2009, Mr. Chavez was admitted to Presbyterian Hospital for narcotic dependence and withdrawal.
- On 11 March 2009, Mr. Chavez underwent a functional capacity evaluation. It was noted that he was cooperative but he did not provide full effort and there was symptom magnification.

- There were no further medical records available for review at this time.
- Color images of the Peterbilt tractor showed a puncture in the fiberglass fuel tank cowling posterior to the passenger step. There was no evidence of longitudinal markings on the Peterbilt in this area. Additionally, this area of the Peterbilt is recessed compared to the area immediately forward. An image of the concrete saw next to the Martin trailer showed it upright with the saw imbedded in the concrete. Mr. Ayala reported that the saw cuts had to be repeated (the saw cut depth was one inch) which required the saw to be backed up in order to make multiple passes. Based on the images of the Peterbilt, Mr. Chavez backed the saw into the Peterbilt resulting in the handle of the saw puncturing the fiberglass component of the Peterbilt. As the Peterbilt subsequently moved forward, the saw fell onto its left side. There was no evidence that the saw was contacted while the Peterbilt tractor was moving forward.
- There was no impact to Mr. Chavez' body therefore the only loading that he experienced was caused by exertion as he tried to prevent the saw from falling over. Any injuries that Mr. Chavez sustained would have been muscle strains resulting from his exertional efforts. In fact, Mr. Chavez was diagnosed with cervical and trapezius strains. These types of muscle strains typically abate without medical treatment within days.
- The biomechanics of degenerative disc disease (DDD) which includes disc herniations, protrusions and bulges, can be understood in the context of the underlying anatomy. Intervertebral discs are composed of a viscous center called the nucleus pulposus surrounded by multiple layers of crisscrossing fibrous sheets that form a structure called the annulus fibrosus. Disc bulges, protrusions and herniations occur when migration of the nuclear material through layers of the annulus causes the outer layer of the annulus to bulge or protrude. In the vast majority of cases, the mechanism by which this occurs is a slow degenerative process that usually starts in the second or third decade of life. [1,2,3,4] Spinal degeneration increases with age and is quite common among asymptomatic individuals in the general population. More than 25% of asymptomatic people less than 40 years of age and almost 60% of asymptomatic people older than 40 years of age have cervical DDD that can be identified on MRI,[5] and approximately 90% of adults under age 55 have evidence of lumbar DDD identified on MRI with 25% to 60% of individuals having moderate to severe disease.[3]
- The anatomy of the intervertebral disc makes it extremely resistant to protrusion and herniation in impact loading, even when degenerated. A review of the biomechanical literature suggests that for almost all modes of loading, disc protrusions and herniations are not the result of a one-time loading event unless bone disruption occurs. [6,7] The types of neck injuries that can result from excessive neck loading have been studied extensively. Traumatic neck injuries have been produced in hundreds of human cadaveric specimens with varying degrees of preexisting disc degeneration ranging from none to severe. [8,9,10,11,12,13,14,15,16] A wide range of injuries has been produced, including fractures of the vertebral body, facets, lamina, transverse and spinous processes and ruptures of the anterior and posterior longitudinal ligaments, intervertebral discs, capsular ligaments, interspinous ligaments and ligamentum flava. Traumatic disc injuries occur

quite rarely and are almost always produced as a result of serious injury to the adjacent bone or ligament. When they do occur, traumatic disc injuries are typically manifested as tears along a transverse cleavage plain. This injury pattern is quite distinct from DDD.

- Although disc protrusions and herniations cannot be generated traumatically under realistic loading conditions in cadaveric specimens, they can reliably be generated by repeated cyclic loading at physiological levels of force.[17,18,19,20,21] In these studies, disc protrusions develop gradually and in some cases the nucleus pulposus eventually extrudes. The failures typically occur progressively over thousands of loading cycles, and not as sudden events.

- Much research has focused on the biomechanical risk factors associated with disc herniations, often in the context of ergonomics and workplace design. However, it is important to recognize that physiological and genetic factors play a much more important role in the development of disc protrusions and herniations than mechanical loading.[22,23] Animal models have shown that disc degeneration can be induced chemically, with no mechanical trauma whatsoever.[24] Epidemiological studies have shown that genetic factors explain 50% - 75% of the variation in the degree of disc degeneration seen in the adult population.[25,26,27,28] This level of explanatory power dwarfs other factors commonly associated with disc degeneration, such as age (9%), lifetime physical loading (7%) and smoking (2%).[22,25] Not only are the structural abnormalities associated with disc degeneration mostly genetic in origin, severe neck pain has also been shown to be about 50% heritable.[27] Suri et al.[29] have shown that in a study group of individuals diagnosed with lumbar disc herniation, the majority were unable to describe an inciting event. A minority of the study group described an inciting event (a strict temporal relationship was not necessary): 26% a non-lifting event, 6.5% a heavy lifting event, 2.0% a light lifting event and 1.3% a traumatic event. This study supports the genetic basis for the development of DDD.

- Given that lifetime physical loading has only a small influence on the development of disc degeneration, the effect of a single episode of minor trauma would be expected to be negligible. However, patients often report a history of back or neck pain following an acute injury, with MRI findings of disc degeneration or herniation documented at some time after the injury. The issue of whether this patient history indicates a coincidental or causal relationship between the traumatic event and the subsequent symptoms and MRI findings has been addressed by controlled scientific studies. In large epidemiological studies,[25,30] it has been found that the patient history of a previous acute injury did not explain subsequent MRI findings of disc degeneration. Nor is there any scientific evidence demonstrating that minor trauma can exacerbate a preexisting disc herniation. In a 2006 study, Carragee conducted a 5-year prospective cohort study of 200 patients in order to investigate whether minor trauma can trigger long-term serious back pain.[30] The study found that the incidence of serious low back pain attributed to minor trauma (including automobile accidents) by the patients was equivalent to the incidence of serious back pain arising spontaneously, proving that the temporal association and

subjective feelings of the patient linking the serious back pain to the minor trauma were coincidental rather than causal. Several other authors have also opined that the relationship between a traumatic event and the radiographic finding of a disc herniation cannot be considered causal.[6,7,20,31]

- Mr. Chavez has a history of preexisting degenerative changes in his spine and these changes are going to progress with time. Mr. Chavez' neck surgery was the result of these degenerative changes which were not caused by the subject event. Interestingly, Mr. Chavez' symptoms have not changed since his neck surgery, therefore it begs the question was the surgery actually needed. Mr. Chavez has inconsistencies in his legal and medical documents regarding the subject event and his past medical condition. Even though it was Mr. Chavez' actions that led to the saw falling onto its left side, he blames the truck driver for an event that he himself caused. At this time, Mr. Chavez' symptoms have to be evaluated in light of his ongoing litigation and any underlying physiological issues.

The opinions expressed herein, to a reasonable medical and scientific probability, reflect my conclusions based upon the information reviewed and the analysis performed as of this date. As additional information is made available to me, or as new facts are uncovered during the investigation and discovery process, my professional opinions may change to reflect the newfound information.

Should you require additional information, please do not hesitate to contact me.

Sincerely,

Charles E. Bain, B.Eng., M.D., C.C.F.P.(E.M.)

CEB/rlm

Enclosures: A. Testifying History
B. Curriculum Vitae
C. Professional Qualifications
D. Principles and Methodology of ICA

[1] Fischgrund, J. S. and H. N. Herkowitz (1998). Cervical Spondylotic Radiculopathy: Natural History and Pathophysiology. The Spine, 4th Edition. H. N. Herkowitz, S. R. Garfin, R. A. Balderston et al. Philadelphia, W.B. Saunders Company.

[2] Garfin, S. R. and H. N. Herkowitz (1996). Lumbar Disc Degeneration: Normal Aging or a Disease Process? The Lumbar Spine. S. W. Wiesel, J. O. Weinstein, H. N. Herkowitz, J. Dvorak and G. R. Bell. Philadelphia, W.B. Saunders Company. **1:** 458-473.

[3] Cheung, K. M., J. Karppinen, et al. (2009). "Prevalence and Pattern of Lumbar Magnetic Resonance Imaging Changes in a Population Study of One Thousand Forty-Three Individuals." Spine **34**(9): 934-940.

[4] Kjaer, P., C. Leboeuf-Yde, et al. (2005). "An Epidemiologic Study of MRI and Low Back Pain in 13-Year-Old Children." Spine **30**(7): 798-806.

[5] Boden, S. D., P. R. McCowin, et al. (1990). "Abnormal Magnetic-Resonance Scans of the Cervical Spine in Asymptomatic Subjects." Journal of Bone and Joint Surgery **72**(8): 1178-1184.

[6] Brinckman, P. (1986). "Injury of the Annulus Fibrosus and Disc Protrusions, An *In Vitro* Investigation on Human Lumbar Discs." Spine **11**(2): 149-153.

[7] King, A. I. (2002). Injury to the Thoracolumbar Spine and Pelvis. Accidental Injury: Biomechanics and Prevention. A. M. Nahum and J. W. Melvin. New York, Springer-Verlag, 2nd Ed.: 454-490.

[8] Nusholtz, G. S., D. E. Huelke, et al. (1983). Cervical Spine Injury Mechanisms. 831616, Society of Automotive Engineers, Warrendale, PA.

[9] Yoganandan, N., A. Sances, et al. (1986). "Experimental Spinal Injuries with Vertical Impact." Spine **11**(9): 855-860.

[10] Nightingale, R. W., B. S. Myers, et al. (1991). The Influence of End Condition on Human Cervical Spine Injury Mechanisms. Proceedings of the 39th Stapp Car Crash Conference, Paper 912915.

[11] Myers, B. S., J. McElhaney, et al. (1991). "The Role of Torsion in Cervical Spine Trauma." Spine **16**(8): 870-874.

[12] Crowell, R. R., M. Shea, et al. (1993). "Cervical Injuries Under Flexion and Compression Loading." Journal of Spinal Disorders **6**(2): 175-181.

[13] Pintar, F., N. Yoganandan, et al. (1995). Dynamic Characteristics of the Human Cervical Spine. Proceedings of the 39th Stapp Car Crash Conference, Paper 952722.

[14] Meyers, B. S. and B. A. Winkelstein (1995). "Epidemiology, Classification, Mechanism, and Tolerance of Human Cervical Spine Injuries." Critical Reviews in Biomedical Engineering **23**(5&6): 307-409.

[15] Nightingale, R. W., J. H. McElhaney, et al. (1997). The Dynamic Responses of the Cervical Spine: Buckling, End Conditions, and Tolerance in Compressive Impacts, 973344, Society of Automotive Engineers, Warrendale, PA.

[16] Duma, S. M., A. Kemper, et al. (2008). Biomechanical Response of the Cervical Spine. Rocky Mountain Bioengineering Symposium & International ISA Biomedical Sciences Instrumentation Symposium, Copper Mountain, CO.

[17] Adams, M. A. and W. C. Hutton (1985). "Gradual Disc Prolapse." Spine **10**(6): 524-531.

[18] Wilder, D. G., M. H. Pope, et al. (1988). "The Biomechanics of Lumbar Disc Herniation and the Effect of Overload and Instability." Journal of Spinal Disorders **1**(1): 16-32.

[19] Gordon, S. J., K. H. Yang, et al. (1991). "Mechanism of Disc Rupture, A Preliminary Report." Spine **16**(4): 450-456.

[20] Callaghan, J. P. and S. M. McGill (2001). "Intervertebral disc herniation: studies on a porcine model exposed to highly repetitive flexion/extension motion with compressive force." Clinical Biomechanics **16**: 28-37.

[21] Tampier, C., J. D. M. Drake, et al. (2007). "Progressive Disc Herniation." Spine **32**(25): 2869-2874.

[22] Battie, M. C., T. Videman, et al. (2009). "The Twin Spine Study: Contributions to a changing view of disc degeneration." The Spine Journal **9**(47-59).

[23] Zhang, Y. G., Z. Sun, et al. (2009). "Risk Factors for Lumbar Intervertebral Disc Herniation in Chinese Population: A Case-Control Study." Spine **34**(25): E918-E922.

[24] Hoogendoorn, R. J., M. N. Helder, et al. (2008). "Reproducible Long-Term Disc Degeneration in a Large Animal Model." Spine **33**(9): 949-954.

[25] Battie, M. C., T. Videman, et al. (1995). "Determinants of Lumbar Disc Degeneration." Spine **20**(24): 2601-2612.

[26] Sambrook, P. N., A. J. MacGregor, et al. (1999). "Genetic Influences On Cervical and Lumbar Disc Degeneration." Arthritis & Rheumatism 42(2): 366-372.

[27] MacGregor, A. J., T. Andrew, et al. (2004). "Structural, Psychological, and Genetic Influences on Low Back and Neck Pain: A Study of Adult Female Twins." Arthritis & Rheumatism 51(2): 160-167.

[28] Battie, M. C., T. Videman, et al. (2008). "Genetic and Environmental Effects on Disc Degeneration by Phenotype and Spinal Level." Spine 33(25): 2801-2808.

[29] Suri, P., D. J. Hunter, et al. (2010). "Inciting events associated with lumbar disc herniation." The Spine Journal 10: 388-395.

[30] Carragee, E., T. Alamin, et al. (2006). "Does Minor Trauma Cause Serious Low Back Illness." Spine 31(25): 1942-2949.

[31] Wisneski, R., S. R. Garfin, et al. (1999). Lumbar Disc Disease. The Spine 4th Edition. H. N. Herkowitz, S. R. Garfin, R. A. Balderston et al. Philadelphia, WB Saunders Company.